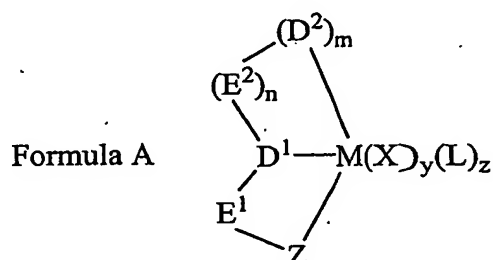


## Claims:

1. A polymerisation catalyst comprising
  - (1) a transition metal compound having the following Formula A, and optionally
  - (2) an activating quantity of a suitable activator,



5

wherein Z comprises a five-membered heterocyclic group, the five membered heterocyclic group containing at least one carbon atom, at least one nitrogen atom and at least one other hetero atom selected from nitrogen, sulphur and oxygen, the remaining

10 atoms in said ring being selected from nitrogen and carbon; M is a metal from Group 3 to 11 of the Periodic Table or a lanthanide metal; E<sup>1</sup> and E<sup>2</sup> are divalent groups independently selected from (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups and (vi) heterosubstituted derivatives of said groups (i) to (v); D<sup>1</sup> and D<sup>2</sup> are

15 donor atoms or groups; X is an anionic group, L is a neutral donor group; n = m = zero or 1; y and z are independently zero or integers such that the number of X and L groups satisfy the valency and oxidation state of the metal M.

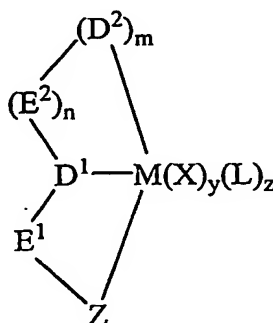
2. A polymerisation catalyst as claimed in claim 1 wherein the five membered

heterocyclic group contains at least 3 carbon atoms in its ring.

3. A polymerisation catalyst as claimed in claim 1 comprising

(1) a transition metal compound having the following Formula A, and optionally

(2) an activating quantity of a suitable activator,



Formula A

wherein Z is specifically an imidazole-containing group; M is a metal from Group 3 to

11 of the Periodic Table or a lanthanide metal; E¹ and E² are divalent groups

independently selected from (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic

groups and (vi) heterosubstituted derivatives of said groups (i) to (v); D¹ and D² are

donor groups; X is an anionic group, L is a neutral donor group; n = m = zero or 1; y

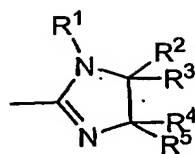
and z are independently zero or integers such that the number of X and L groups satisfy the valency and oxidation state of the metal M.

4. A polymerisation catalyst as claimed in any one of Claims 1 to 3 wherein M is a metal from Group 3 to 7 of the Periodic Table or a lanthanide metal.

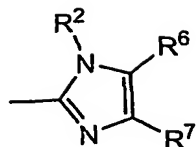
5. A polymerisation catalyst as claimed in any one of the preceding Claims wherein D¹ and / or D² are an imidazole-containing group.

6. A polymerisation catalyst as claimed in any one of Claims 3 to 5 wherein D² and Z are identical imidazole containing groups.

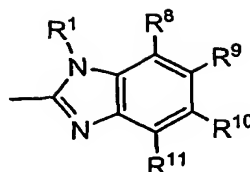
7. A polymerisation catalyst as claimed in any one of Claims 3 to 6 wherein the imidazole-containing group Z is selected from a group of Formula I, II or III



Formula I



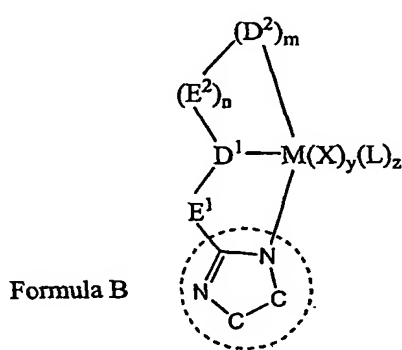
Formula II



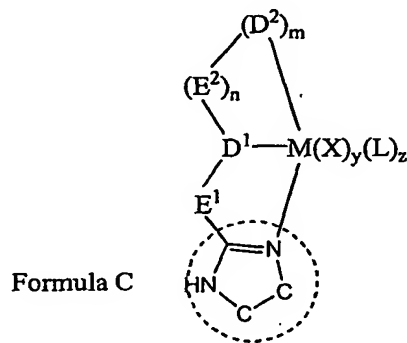
Formula III

R<sup>1</sup> to R<sup>11</sup> are independently hydrogen or a monovalent (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups, (vi) heterosubstituted derivatives of said groups (i) to (v), and (vii) hydrocarbyl-substituted heteroatom groups.

8. A polymerisation catalyst as claimed in Claim 1 wherein the a transition metal compound has the following Formula B or C

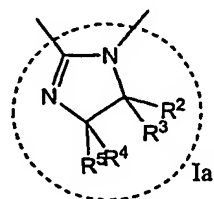


Formula B

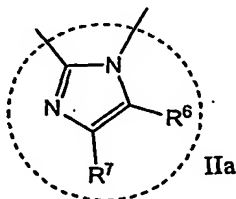


Formula C

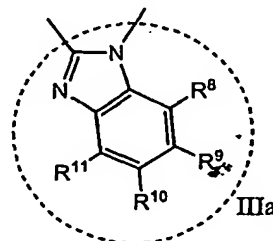
wherein the imidazole nucleus shown within the dotted circle is selected from the divalent groups represented by the Formulae Ia, IIa, IIIa, IVa, Va and VIa,



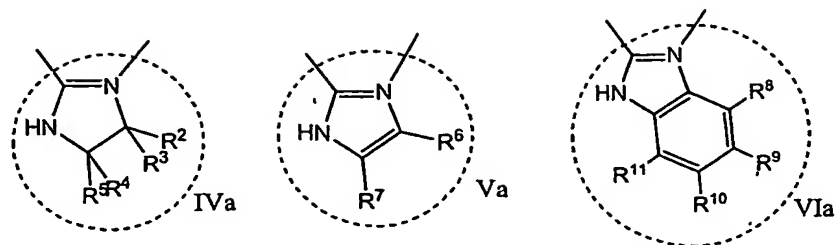
Ia



IIa



IIIa



wherein M is a metal from Group 3 to 11 of the Periodic Table or a lanthanide metal; E<sup>1</sup> and E<sup>2</sup> are divalent groups independently selected from (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups and (vi) heterosubstituted derivatives of said groups (i) to (v); D<sup>1</sup> and D<sup>2</sup> are donor groups; X is an anionic group, L is a neutral donor group; n = m = zero or 1; y and z are independently zero or integers such that the number of X and L groups satisfy the valency and oxidation state of the metal M,

wherein the groups R<sup>2</sup> to R<sup>11</sup> are independently hydrogen or a monovalent (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups, (vi) heterosubstituted derivatives of said groups (i) to (v), and (vii) hydrocarbyl-substituted heteroatom groups.

9. A polymerisation catalyst as claimed in any one of the preceding Claims wherein E<sup>1</sup> and E<sup>2</sup> are independently selected from -CH<sub>2</sub>-, -CH<sub>2</sub>CH<sub>2</sub>-, -CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>-, 1,2-phenylene, *trans*-1,2-cyclopentane, *trans*-1,2-cyclohexane, 2,3-butane, 1,1'-biphenyl, 1,1'-binaphthyl, and -Si(Me)<sub>2</sub>-.

10. A polymerisation catalyst as claimed in any one of Claims 1 to 4 or 8 wherein D<sup>1</sup> and D<sup>2</sup> are selected from oxygen, sulfur, an amine of formula -N(R<sup>12</sup>)- or a phosphine of formula -P(R<sup>13</sup>)- wherein R<sup>12</sup> and R<sup>13</sup> are hydrogen or (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups, (vi) heterosubstituted derivatives of said groups (i) to (v), (vii) hydrocarbyl-substituted heteroatom groups and (viii) an imidazole-containing group.

11. A polymerisation catalyst as claimed in any one of the preceding Claims wherein M is selected from Sc, Ti, Zr, Hf, V, Nb, Ta, Cr, Mo and W.

12. A polymerisation catalyst as claimed in any one of the preceding Claims wherein the anionic group X is selected from a halide, a hydrocarbyl group, a carboxylate, an

oxide; an amide; an alkoxide; an acetylacetonate; and a hydroxyl.

13. A polymerisation catalyst as claimed in any one Claims 1 to 11 wherein X is a non-coordinating or weakly-coordinating anion.

14. A polymerisation catalyst as claimed in any one of the preceding Claims wherein the neutral donor group L is selected from an ether, an amine, a phosphine, an olefin, water and a neutral, conjugated or nonconjugated diene,

15. A polymerisation catalyst as claimed in any one of the preceding Claims wherein the optional activator (2) is selected from organoaluminium compounds and organoboron compounds and mixtures thereof.

16. A polymerisation catalyst as claimed in Claim 15 wherein the optional activator (2) is selected from trimethylaluminium, triethylaluminium, tributylaluminium, tri-n-octylaluminium, ethylaluminium dichloride, diethylaluminium chloride, tris(pentafluorophenyl)aluminium, alumoxanes, dimethylphenylammoniumtetra(phenyl)borate, trityltetra(phenyl)borate, triphenylboron, dimethylphenylammonium tetra(pentafluorophenyl)borate, sodium tetrakis[(bis-3,5-trifluoromethyl)phenyl]borate,  $H^+(OEt_2)[(bis-3,5-trifluoromethyl)phenyl]borate$ , trityltetra(pentafluorophenyl)borate and tris(pentafluorophenyl) boron.

17. A polymerisation catalyst as claimed in any one of the preceding Claims wherein the optional activator is provided by a Lewis acid selected from

(a) ionic-bonding compounds having a  $CdCl_2$  type or a  $CdI_2$  type of layered crystal structure;

(b) clays, clay minerals, or ion-exchange layered compounds;

(c) heteropoly-compounds; and

(d) halogenated lanthanoid compounds.

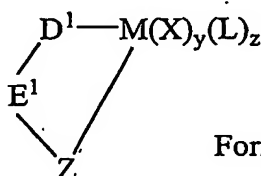
18. A polymerisation catalyst as claimed in any one of the preceding Claims wherein the optional activator is provided by a catalyst support-activator agglomerate comprising a composite of (A) at least one inorganic oxide component selected from  $SiO_2$ ,  $Al_2O_3$ ,  $MgO$ ,  $AlPO_4$ ,  $TiO_2$ ,  $ZrO_2$ , and  $Cr_2O_3$  and (B) at least one ion containing layered material comprising a smectite.

19. A polymerisation catalyst as claimed in any one of the preceding Claims wherein there is present a promoter comprising a halogenated organic compound.

20. A polymerisation catalyst as claimed in Claim 19 wherein the promoter is selected from carbon tetrachloride, hexachloroethylene, benzylbromide, benzylchloride, ethyl trichloroacetate and 2,3- or 1,3-dichloropropylene, chloroform ( $\text{CHCl}_3$ ) and n-butylchloride.

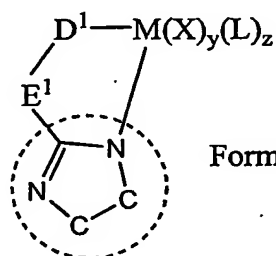
21. A polymerisation catalyst as claimed in Claim 20 wherein the transition metal is vanadium.

21. A polymerisation catalyst as claimed in any one of the preceding Claims wherein m and n are zero in Formula A so that the transition metal compound is of Formula D

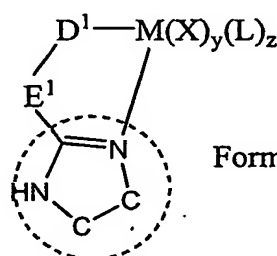


Formula D

22. A polymerisation catalyst as claimed in any one of the preceding Claims wherein m and n are zero in Formula A so that the transition metal compound is of Formula E or Formula F

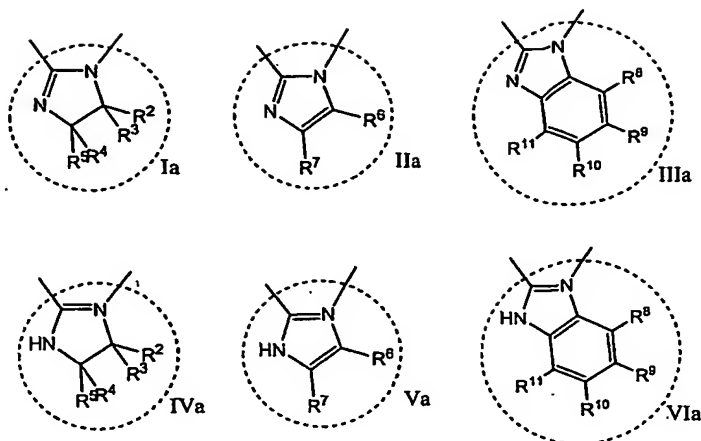


Formula E



Formula F

and wherein the imidazole nucleus within the dotted circle is selected from the divalent groups represented by the Formulae Ia, IIa, IIIa, IVa, Va and VIa as follows:



23. A polymerisation catalyst as claimed in any one of the preceding Claims wherein in addition to the defined catalyst there is present one or more other catalysts for polymerising 1-olefins.

5 24. A polymerisation catalyst as claimed in any one of the preceding Claims wherein in addition to the defined catalyst there is present one or more other transition metal catalysts selected from Ziegler-Natta catalyst systems, metallocene-based catalysts, or heat activated supported chromium oxide catalysts.

10 25. A supported catalyst comprising the polymerisation catalyst defined in any one of the preceding Claims and a support material.

26. A process for the polymerisation and copolymerisation of 1-olefins, cycloolefins or dienes, comprising contacting the monomeric olefin under polymerisation conditions with the polymerisation catalyst claimed in any one of the preceding Claims.

15 27. A process as claimed in Claim 26 wherein the process is for the homopolymerisation of 1-olefins and wherein the monomer is selected from ethylene, propylene, butene, hexene, and styrene.

28. A process as claimed in Claim 26 wherein the process is for the copolymerisation of 1-olefins and wherein the monomer is selected from ethylene, propylene, 1-butene, 1-hexene, 4-methylpentene-1, octane, methyl methacrylate, methyl  
20 acrylate, butyl acrylate, acrylonitrile, vinyl acetate, vinyl chloride, and styrene.

29. A process as claimed in Claim 26 comprising the copolymerisation of ethylene and or propylene with comonomers selected from 1-butene, 1-hexene, 4-methylpentene-1, methyl methacrylate, methyl acrylate, butyl acrylate, acrylonitrile, vinyl acetate, and styrene, diene, cyclic olefin, norbornene and substituted norbornene.

30. A process as claimed in any one of Claims 26 to 29 wherein the catalyst is supported on a support material selected from silica, alumina, zirconia, talc, kieselguhr, magnesia, magnesium chloride and polymers.

31. A process as claimed in any one of Claims 26 to 30 wherein the process is carried out under gas phase, slurry phase or solution phase polymerisation conditions.

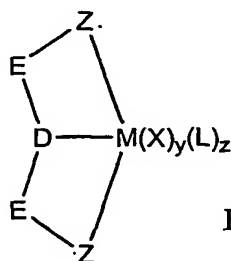
32. A process as claimed in any one of Claims 26 to 31 wherein the process is carried in the presence of hydrogen gas to modify the average molecular weight of the produced polymer.

33. A process for oligomerisation and cooligomerisation of 1-olefins, comprising contacting the monomeric olefin under oligomerisation conditions with the catalyst claimed in any one of Claims 1 to 25.

34. A polymerisation catalyst comprising

(1) a transition metal compound having the following Formula A1, and optionally

(2) an activating quantity of a suitable activator,



Formula A1

wherein Z is specifically an imidazole-containing group; M is a metal from Group 3 to 7 of the Periodic Table or a lanthanide metal; E is a divalent group independently selected from (i) aliphatic hydrocarbon, (ii) alicyclic hydrocarbon, (iii) aromatic hydrocarbon, (iv) alkyl substituted aromatic hydrocarbon (v) heterocyclic groups and (vi) heterosubstituted derivatives of said groups (i) to (v); D is a donor group; X is an anionic group, L is a neutral donor group; y and z are independently zero or integers such that the number of X and L groups satisfy the valency and oxidation state of the metal M.